

# TE SENSOR SOLUTIONS FOR AEROSPACE AND DEFENSE

# TE SENSOR SOLUTIONS FOR AEROSPACE AND DEFENSE

TE Connectivity (TE) is one of the largest connectivity and sensor companies in the world. Our broad portfolio of sensor technologies is designed for a wide range of mission critical applications in Aerospace and Defense and other industries. By leveraging our core competencies in high reliability sensors for harsh environments such as Temperature, RFI, EMI, Vibration, and Lightning, we enable our customers to transform their concepts into creations — redefining what's possible using intelligent, efficient and high-performing TE products and solutions.



## SENSOR TYPES

- FLOW
- FLUID PROPERTY
- FORCE/TORQUE
- HUMIDITY
- LIQUID LEVEL
- RATE/INERTIAL
- POSITION
- PRESSURE
- TEMPERATURE
- ULTRASONIC
- VIBRATION/SHOCK

## QUALITY STATEMENTS

- AS/EN 9100
- ATEX
- ESA/ESCC QUALIFIED
- NADCAP
- ISO 14001
- ISO 9001
- MEASURING INSTRUMENTS  
DIRECTIVE 2004/22/EC ANNEX D
- NASA/GSFC QUALIFIED
- PART21G
- TS 16949

## DESIGN/DEVELOPMENT

- DO-160
- DO-254
- MIL-STD-810
- GRESS

# APPLICATION SOLUTIONS

Long development cycles and high qualification costs require aerospace companies to identify stable, reliable, cost-effective partners. TE Connectivity has design engineering groups, as well as AS9100 certified sensor manufacturing facilities, in North America, Europe and Asia Pacific which support Tier 1, 2 and 3 providers with a wide variety of critical sensor solutions for aerospace and defense applications. Regional design and manufacturing allows TE to furnish ITAR free designs and supply products close to our customers' assembly facilities.

## Cockpit Controls

- Automatic autopilot disconnect force sensors
- Motorized potentiometers for position feedback
- Brake pedal position sensors
- Rotary panel switches and sensors
- Force sensors for flight data recording of pilot inputs
- Throttle quadrant position sensors
- Flap and spoiler lever position sensors

## Flight Controls & Actuation

- High lift load sensors
- THSA secondary load path engagement sensors
- Aileron LVDT position sensors
- Resolvers for flap and slat position monitoring
- Force and position sensors for spoiler electro-mechanical actuation
- Brake actuator force sensors for rotorcraft

## Landing Gear & Brakes

- Brake torque sensors
- Pressure sensors for Nose Wheel steering feedback
- Resolvers for steering position
- Load on wheels force sensors
- Centre of gravity force sensors

## Cabin, Galley & Cargo

- Cabin pressure indicator
- Waste tank level sensors
- Environmental cabin control pressure sensors
- Cargo humidity sensors
- Galley temperature sensors
- Air quality temperature sensors
- Oxygen generation pressure transducers

## Launch & Space

- Payload monitoring vibration sensors
- Thrust vectoring LVDT position sensors
- Electrical actuator position resolvers
- Booster separation potentiometers
- Cryogenic fuel pressure transducers
- Satellite temperature sensors
- Mirror/antenna position LVDT sensors

## Engine, Turbine & APU

- Thermocouple harnesses for exhaust gas temperature
- LVDT for thrust reverser position monitoring
- Platinum 200 air temperature sensors
- Variable bleed valve LVDT position sensors
- Rotor track and Balance accelerometers
- Health and Usage Monitoring Systems(HUMS) accelerometers
- Thermistor heater fuel tank level and flow

## Military (Missile, Ground Vehicle, Marine, UAV...)

- Missile fin actuation
- Fuel tank level & flow sensors
- Gun stabilization and shock measurement
- Tamper detection for missiles
- Electronic safe arm and fire
- Oil pressure and temperature sensors
- Airspeed and altitude sensors



# TE SENSOR SOLUTIONS FOR AEROSPACE AND DEFENSE

## Pressure Sensors

Board Mounted  
mV Output



### 1230

Package	8 pin DIL
Type	Gage, absolute, differential
Pressure Range	0 - 5 & 10" H <sub>2</sub> O 0 - 0.07, 0.14, 0.35, 1, 2, 3, 7 bar / 0 - 1, 2, 5, 15, 30, 50, 100 psi
Output/Span	50 mV and 100 mV typical
Unique Features	<ul style="list-style-type: none"> <li>• Temperature compensated</li> <li>• High performance UltraStable die Current excitation</li> </ul>
Accuracy	±0.1% Non-linearity
Operating Temp	-40°C to 125°C
Dimensions (mm)	15.2 x 20.3
Typical Apps	Air flow measurement, leak detection, cabin control, ventilation



### MS52xx, MS54xx

Package	Surface mount
Type	Gage, absolute
Pressure Range	0 - 1, 12 bar / 0 - 15, 174 psi (MS52xx) 0 - 1, 7, 12 bar / 0 - 15, 102, 174 psi (MS54xx)
Output/Span	150 mV, 240 mV
Unique Features	<ul style="list-style-type: none"> <li>• Small size (MS54xx)</li> <li>• High linearity or high sensitivity options</li> <li>• Plastic tube or metal ring options</li> <li>• With gel to protect against moisture</li> <li>• High endurance (Option HM)</li> </ul>
Accuracy	±0.05% or ±0.2% Non-linearity
Operating Temp	-40°C to 125°C
Dimensions (mm)	7.6 x 7.6, height model dependent (MS52xx) 6.4 x 6.2 (MS54xx)
Typical Apps	Absolute pressure sensor systems, engine controls, high resolution altimeters, variometers, barometers

Media Isolated Modules  
Analog Output



### 89 Button, 89 with Fittings

Package	O-ring mount and threaded / weldable or process fitting
Type	Sealed gage, absolute
Pressure Range	0 - 69, 207, 345 bar / 0 - 1K, 3K, 5K psi
Output/Span	100 mV typical
Unique Features	<ul style="list-style-type: none"> <li>• High pressure, modular design</li> </ul>
Accuracy	±0.25% FSO Non-linearity
Operating Temp	-40°C to 125°C
Dimensions (mm)	89 Button: Ø 9.0 x 7.5 89 with Fittings: Ø 22.2 x 23.6
Typical Apps	Air tank pressure, hydraulics, process control, oxygen generation, inerting systems

## Transducers and Transmitters



### P900

Package	Threaded ports with stainless steel housing and various heavy duty electrical connections, various electrical outputs
Type	Gage, absolute
Pressure Range	0 - 5 bar to 0 - 689 bar / 0 - 75 psi to 0 - 10K psi
Output/Span	0 - 5 Vdc, 0 - 10 Vdc, 4 - 20 mA
Unique Features	<ul style="list-style-type: none"> <li>• High overpressure (10X over pressure)</li> <li>• Shock &amp; vibration resistant</li> <li>• Heavy Industrial grade transducer</li> <li>• Advanced digital compensation / calibration</li> <li>• Mechanical over pressure stops</li> <li>• High temperature operation</li> </ul>
Accuracy	0.1% to 0.2% FSO
Operating Temp	-54°C to 120°C
Dimensions (mm)	Application dependent
Typical Apps	Hydraulic controls / steering, torpedo depth, vehicle braking systems, drones, weapon systems
Agency Approvals	CE, CENELEC (Intrinsically Safe)



### M7100, U7100

Package	Automotive grade, stainless steel hermetic pressure ports and integral electrical connector, heavy duty
Type	Gage, no vent gage (M7100) Gage, sealed gage, absolute (U7100)
Pressure Range	0 - 10 thru 0 - 689 bar / 0 - 150 thru 0 - 10K psi (M7100) 0 - 1 thru 0 - 10 bar / 0 - 15 thru 0 - 150 psi (U7100)
Output/Span	0.5 - 4.5 Vdc [Ratiometric Output]; 1 - 5 Vdc [Regulated] (M7100) 0.5 - 4.5 Vdc [Ratiometric Output] (U7100)
Unique Features	<ul style="list-style-type: none"> <li>• 1% total error band (-20°C to 85°C)</li> <li>• Solid state reliability</li> <li>• Survives high vibration and immersion</li> <li>• Microfused technology (M7100)</li> <li>• UltraStable technology (U7100)</li> </ul>
Accuracy	0.25% FSO
Operating Temp	-40°C to 125°C
Dimensions (mm)	26.7 x 26.7 x 50.0
Typical Apps	Military vehicles engine control, compressors, hydraulic
Agency Approvals	CE (EMC), UL 508

## Pressure Sensors

Miniature Transducers and Transmitters



### XP Series

<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Titanium construction (XP5, XPM4)</li> <li>• Stainless steel housing (XPM6, XPM10)</li> <li>• Amplified output options (XP5, XPM6, XPM10)</li> <li>• Cable and connector options (XPM4)</li> <li>• For static and dynamic applications</li> </ul>
<b>Non Linearity</b>	Up to $\pm 0.25\%$ FSO (XP5, XPM6, XPM10) Up to $\pm 0.35\%$ FSO (XPM4)
<b>Output/Span</b>	20, 30, 75, 100mV (XP5) 30mV, 60mV, 100mV (XPM4) 100mV (XPM6) 50, 100mV (XPM10)
<b>Pressure Range</b>	1 - 345 bar / 15 - 5K psi (XP5, XPM10) 5 - 207 bar / 75 - 3K psi (XPM4) 103 - 1K bar / 1.5K - 15K psi (XPM6)
<b>Overpressure</b>	2X
<b>Operating Temp</b>	-40°C to 120°C
<b>Dimensions (mm)</b>	XP5: Hex 10 XPM4: Hex 8 XPM6: Hex 12 XPM10: Hex 15
<b>Typical Apps</b>	Military and aerospace, explosive test benches, space



### XPC10

<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Amplified output available</li> <li>• For static and dynamic applications</li> <li>• Optional IP67 ingress protection</li> <li>• High temperature operation</li> </ul>
<b>Non Linearity</b>	Up to $\pm 0.25\%$ F.S.
<b>Output/Span</b>	12mV FSO, 4V FSO (amplified)
<b>Pressure Range</b>	0 - 10, 21, 34, 52, 69, 103, 207, 345, 517 bar / 0 - 150, 300, 500, 750, 1K, 1.5K, 3K, 5K, 7.5K psi
<b>Overpressure</b>	1.5X
<b>Operating Temp</b>	-40°C to 220°C
<b>Dimensions (mm)</b>	Hex 15
<b>Typical Apps</b>	Aerospace, test benches, high frequency / high temperature pressure applications



### EPIH

<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Diffused silicon diaphragm with a large variety of sizes and shapes available as small as 0.05" outside diameter</li> <li>• High frequency response (to 1.7 MHz)</li> </ul>
<b>Non Linearity</b>	$\pm 1.0\%$ FSO
<b>Output/Span</b>	12 mV to 75 mV
<b>Pressure Range</b>	0 - 0.35, 0.69, 1, 2, 3, 5, 7, 14, 21 bar / 0 - 5, 10, 15, 25, 50, 75, 100, 200, 300 psi
<b>Overpressure</b>	2X to 5X
<b>Operating Temp</b>	-40°C to 120°C
<b>Dimensions (mm)</b>	Application dependent
<b>Typical Apps</b>	Aerospace testing, wind tunnels, aircraft body and wing dynamics

## Force / Torque Sensors



### FN HL Series

<b>Package</b>	Flange mount
<b>Operating Mode</b>	Tension/Compression
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Extremely robust design</li> <li>• Very high EMC/RFI immunity</li> </ul>
<b>Ranges N (Lbf)</b>	Airframe dependent
<b>Output</b>	4/20 mA
<b>Temperature Range</b>	-70°C to +90°C
<b>Dimensions</b>	Airframe dependent
<b>Typical Apps</b>	Measurement of force between geared rotary actuator and slat on high lift systems



### FN TH Series

<b>Package</b>	Load pin
<b>Operating Mode</b>	Tension
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Built in test feature</li> <li>• Dual redundant</li> <li>• Very high ultimate load</li> </ul>
<b>Ranges N (Lbf)</b>	Airframe dependent
<b>Output</b>	0.5 to 5.5Vdc or 4/20mA
<b>Temperature Range</b>	-70°C to +90°C
<b>Dimensions</b>	Airframe dependent
<b>Typical Apps</b>	Detection of secondary load path engagement on trimmable horizontal stabilizer actuator



### FN PC Series

<b>Package</b>	Tail stock/control rod
<b>Operating Mode</b>	Tension/Compression
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Compact</li> <li>• Extremely high performance design</li> <li>• Mono or dual channel</li> </ul>
<b>Ranges N (Lbf)</b>	Airframe dependent
<b>Output</b>	0.5 to 10.5Vdc
<b>Temperature Range</b>	-55°C to +55°C
<b>Dimensions</b>	Airframe dependent
<b>Typical Apps</b>	Monitoring of pilot input forces for flight data recording

## Force / Torque Sensors



### FN EM Series

Package	Pancake
Operating Mode	Compression
Unique Features	<ul style="list-style-type: none"> <li>• Ultra-flat for integration directly into electro-mechanical actuators</li> </ul>
Ranges N (Lbf)	Airframe dependent
Output	0.5 to 10.5Vdc
Temperature Range	-55°C to 55°C
Dimensions	Airframe dependent
Typical Apps	Compression force measurement electro-mechanical actuators



### VR BT Series

Pin	
Torque	
Unique Features	<ul style="list-style-type: none"> <li>• High temperature variable reluctance technology</li> </ul>
Ranges N (Lbf)	Airframe dependent
Output	50mV rms (AC)
Temperature Range	-40°C to 150°C
Dimensions	Airframe dependent
Typical Apps	Monitoring of force brakes



### FN AF Series

Load pin	
Compression	
Unique Features	<ul style="list-style-type: none"> <li>• Built in test feature, dual redundant</li> <li>• Very high ultimate load</li> </ul>
Ranges N (Lbf)	Airframe dependent
Output	0.5 to 5.5Vdc or 4/20mA
Temperature Range	-70°C to 90°C
Dimensions	Airframe dependent
Typical Apps	Monitoring of force between the electrical actuator and the ailerons

## Temperature Sensors

### Sensing Elements



### Platinum Thin Film Chips

RTD Package	Leadless chips
Type	<ul style="list-style-type: none"> <li>• Thin film platinum deposited on ceramic substrate</li> <li>• Contact pads on top and bottom side for NTC chip like assembly</li> <li>• Contact pads on both ends for SMT</li> </ul>
Resistance Range	100Ω, 1000Ω (Other values on request)
Unique Features	<ul style="list-style-type: none"> <li>• Long term stability</li> <li>• Interchangeability</li> <li>• Assembly like NTC chips</li> <li>• Very small dimensions</li> <li>• Short response time</li> </ul>
Accuracy	According to DIN EN 60751
Operating Temp	-50°C to +400°C
Dimensions (mm)	1.5 x 1.5 (top / bottom pads) 1.2 x 3.6 (SMT)
Typical Apps	Aerospace, test and measurement



### Platinum Thin Film Sensors

Wired component	
Unique Features	<ul style="list-style-type: none"> <li>• Thin film platinum deposited on ceramic substrate, glass coated</li> <li>• Tube outline available</li> <li>• Connection via radial leads</li> </ul>
Resistance Range	100Ω, 1000Ω (Other values on request)
Unique Features	<ul style="list-style-type: none"> <li>• Long term stability</li> <li>• Interchangeability</li> <li>• Small dimensions</li> <li>• Short response time</li> <li>• High electrical insulation</li> </ul>
Accuracy	Class T (F0.1), A (F0.15), B (F0.3) according to DIN EN 60751
Operating Temp	-50°C to 600°C (standard) down to -200 °C or up to 1000 °C (on request)
Dimensions (mm)	2.0 x 2.3 x 1.1 (standard) 1.2 x 4.0 x 1.1 (standard) other dimensions (on request)
Typical Apps	Aerospace, test and measurement



### Glass Wire Wound Sensors

GO, GX	
Unique Features	<ul style="list-style-type: none"> <li>• RTD</li> <li>• Glass rod</li> <li>• Radial leads</li> </ul>
Resistance Range	100Ω (2x100Ω on few versions)
Unique Features	<ul style="list-style-type: none"> <li>• Aggressive environments (acid, oil, solvent)</li> <li>• Small dimensions</li> <li>• Stability</li> <li>• No hysteresis</li> <li>• Short response time</li> <li>• Interchangeability</li> </ul>
Accuracy	Class W0.3, W0.15, W0.1 according to IEC60751
Operating Temp	-200°C to 400°C
Dimensions (mm)	Ø 1.8 / Length 5mm to Ø 4.5 / Length 48mm
Typical Apps	Aviation and aeronautics



## Temperature Sensors

### Sensing Elements



#### Space Qualified (Hi-Rel)

<b>Package</b>	Radial, bead, custom
<b>Type</b>	<ul style="list-style-type: none"> <li>Epoxy</li> <li>Glass</li> <li>Probes</li> <li>ESCC 4006013</li> <li>ESCC 4006014</li> <li>GSFC 319-P18</li> <li>449900 Series</li> </ul>
<b>Resistance Range</b>	1kΩ to 100kΩ
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>ESA and NASA approved</li> <li>High reliability and accuracy</li> </ul>
<b>Accuracy</b>	0.5% to 10%
<b>Operating Temp</b>	-55°C to 115°C
<b>Dimensions (mm)</b>	From 2.4
<b>Typical Apps</b>	Instrumentation and compensation



#### Nickel RTD

<ul style="list-style-type: none"> <li>SOT 23, bare die on request</li> <li>Thin film nickel structure on silicon substrate, protected with a passivation layer</li> <li>SOT23 Package for SMT</li> <li>Good thermal connection of sensing element through leadframe-pin</li> <li>Bare die for COB assembly</li> </ul>	
<b>Resistance Range</b>	1000Ω
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>Harsh environment compatible</li> <li>Automotive qualified</li> <li>Very small dimensions</li> <li>Very short response time</li> <li>Good linearity</li> <li>High temperature coefficient</li> <li>Low power consumption</li> </ul>
<b>Accuracy</b>	Class B, according to former DIN 43760 standard
<b>Operating Temp</b>	-55 °C to 160 °C
<b>Dimensions (mm)</b>	2.1 x 2.5 x 2.1 (SOT23), 0.7 x .7 x 0.4 (bare die)
<b>Typical Apps</b>	Thermal compensation, thermal management



#### Radial Leaded Thermistors

<ul style="list-style-type: none"> <li>Radial, axial, beads</li> <li>NTC</li> <li>Epoxy or glass coated</li> </ul>	
<b>Resistance Range</b>	100 to 1MΩ
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>Interchangeable</li> <li>Moisture resistant</li> <li>Stability</li> </ul>
<b>Accuracy</b>	0.25% to 20%
<b>Operating Temp</b>	-55°C to 280°C
<b>Dimensions (mm)</b>	0.4 to 4.9
<b>Typical Apps</b>	Temperature sensing for OEM



#### Axial Thermistors

<ul style="list-style-type: none"> <li>DO-35</li> <li>NTC</li> <li>Glass coated</li> </ul>	
<b>Resistance Range</b>	5kΩ to 100kΩ
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>Tight tolerance (±1%)</li> <li>Max stability using high density (HD) chip</li> <li>Hermetically sealed</li> <li>Tinned &amp; Nickel plated leads</li> </ul>
<b>Accuracy</b>	±1% to ±3%
<b>Operating Temp</b>	-40°C to 300°C
<b>Dimensions (mm)</b>	2.0 x 4.0 body
<b>Typical Apps</b>	Fire detection units, PCB temp sensing

## Sensor Assemblies



#### Thermocouple Probes and Harnesses

<b>Package</b>	Screw-in or push-in design with cable extension, connector, or connecting head
<b>Type</b>	<ul style="list-style-type: none"> <li>Collapsible Mineral Insulated (MI) with alloy sheath (radius ≥ 5*OD)</li> <li>Flexible cable with plastic or composite insulation</li> <li>Rigid protection sheath: ceramic, quartz or alloy sheath</li> </ul>
<b>Sensor Range</b>	Type T, J, K, N, R, S, B (According to TC type and insulation type)
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>High temperature and high vibration level (for MI)</li> <li>Available in small diameters for fast respond time</li> <li>Grounded or ungrounded or apparent hot junction</li> <li>Single or multiple measuring points</li> </ul>
<b>Accuracy</b>	Class 1 according to IEC584
<b>Operating Temp</b>	-40°C to 1700°C (according to TC type and insulation type)
<b>Dimensions (mm)</b>	<ul style="list-style-type: none"> <li>OD Ø0.3 mm to Ø8 mm for MI</li> <li>Ø0.15mm for smallest flexible cable</li> <li>Custom dimensions, fittings and cable lengths (from few centimeters to many meters)</li> </ul>
<b>Typical Apps</b>	Engine temperature



#### Surface Sensors

<ul style="list-style-type: none"> <li>Silicone rubber or polyimide laminated element, SP683</li> <li>Flat, flexible, rectangular sensor</li> <li>Variety of designs available</li> </ul>	
<ul style="list-style-type: none"> <li>RTD: Pt, Ni, Cu</li> <li>Thermocouple: Type J, K, T, E</li> </ul>	
<ul style="list-style-type: none"> <li>Surface sensing for curved or uneven surfaces</li> <li>Noninvasive, simple installation</li> <li>Adhesive backing option</li> </ul>	
<b>Accuracy</b>	RTD: Class A, B according to IEC60751
<b>Operating Temp</b>	Varies: -50°C to 200°C Available up to 220°C
<b>Dimensions (mm)</b>	Custom dimensions available
<b>Typical Apps</b>	Aerospace, motor end windings of stator coils, generators

## Position Sensors

Angular Position Sensors, Encoders Absolute



### Resolver

Package	Hollow Shaft, Size 15
Range	360 degrees absolute
Output	Analog (sin, cos)
Input Voltage (VR1-R2), Typical	2V rms - 10Vrms
Input Frequency, Typical	4kHz - 20kHz
Operating Temperature	-55°C to 150°C
Angular Error Rang, Typical	±7 arcmin to ± 20 arcmin
Pairs of Pole	1 / 3
Maximum Rational Speed	20,000 rpm
Weight	Approx. 90g
Unique Feature	Robust, wear-free, EMI insensitive
Typical Apps	Angular position of rotary actuators, rotating shafts



### Resolver

Package	Hollow Shaft, Size 21
Range	360 degrees absolute
Output	Analog (sin, cos)
Input Voltage (VR1-R2), Typical	2V rms - 12V rms
Input Frequency, Typical	2kHz - 15kHz
Operating Temperature	-55°C to 150°C
Angular Error Rang, Typical	±7 arcmin to ± 20 arcmin
Pairs of Pole	1 / 2 / 3 / 4
Maximum Rational Speed	20,000 rpm
Weight	Approx. 240g
Unique Feature	Robust, wear-free, EMI insensitive
Typical Apps	Angular position of e-motors (commutation) and permanent magnet generators



### Resolver

Package	Input Shaft, Integrated Bearing, Size 11
Range	360 degrees absolute
Output	Analog (sin, cos)
Input Voltage (VR1-R2), Typical	2V rms
Input Frequency, Typical	2,5kHz
Operating Temperature	-55°C to 150°C
Angular Error Rang, Typical	±10 arcmin
Pairs of Pole	1
Maximum Rational Speed	10,000 rpm
Weight	Approx. 120g
Unique Feature	Robust, wear-free, EMI insensitive
Typical Apps	Measuring angular position of cockpit controls (lever, stick and pedal)



### Synchro

Package	Input Shaft, Integrated Bearing, Size 11
Range	360 degrees absolute
Output	Analog (3 phase)
Input Voltage (VR1-R2), Typical	21V rms - 26V rms
Input Frequency, Typical	400Hz - 2500Hz
Operating Temperature	-55°C to 150°C
Angular Error Rang, Typical	±5 arcmin to ±10 arcmin
Pairs of Pole	1
Maximum Rational Speed	10,000 rpm
Weight	Approx. 150g
Unique Feature	Robust, wear-free, EMI insensitive
Typical Apps	Angular position of cockpit controls (lever, stick and pedal)



### Multiturn Position Sensor Unit

Package	Input Shaft, Integrated Bearing, Customized [1]
Range	Multiturn (50.400 to 129.600) degree
Output	2 x Analog (3 phase), Redundant
Input Voltage (VR1-R2), Typical	21V rms - 26V rms
Input Frequency, Typical	400Hz - 2500Hz
Operating Temperature	-55°C to 90°C
Angular Error Rang, Typical	±80 arcmin (400Hz) / ±25 arcmin (2.500Hz)
Pairs of Pole	1
Maximum Rational Speed	600 rpm
Weight	Approx. 935g [1]
Unique Feature	Robust, DO160 qualified
Typical Apps	Multiturn position of primary and secondary flight control actuators



## Position Sensors

Potentiometers

Angular Position Sensors



**6000 Series**  
Servo Mount

<b>Package</b>	<ul style="list-style-type: none"> <li>• 12.7 mm - 50.8 mm / .500 in - 2.00 in housing diameter</li> <li>• 3.170mm - 6.34mm / .1248 in - .2498 in shaft diameter</li> <li>• 12.7mm - 1.74mm / .500 in - .680 in housing length</li> <li>• 11.1mm - 47.62mm / .438 in - 1.875 in mounting pilot diameter</li> </ul>
<b>Resistance</b>	1K - 20K
<b>Range</b>	Up to 355 degrees
<b>Linearity</b>	± 0.5%
<b>Output Smoothness</b>	<0.1%
<b>Resolution</b>	Infinite
<b>Operating Temp</b>	-65°C to 125°C
<b>Rotational Life</b>	50 million cycles min.
<b>Typical Apps</b>	Flight control actuators, missile fin actuators



**6200 Series**  
Bushing Mount

<b>Package</b>	<ul style="list-style-type: none"> <li>• 12.7 mm - 50.8 mm / .500 in - 2.00 in housing diameter</li> <li>• 3.170mm - 6.34mm / .1248 in - .2498 in shaft diameter</li> <li>• 12.7mm - 1.74mm / .500 in - .680 in housing length</li> <li>• 3/8 32 NEF thread / 10.31mm / .4062 in pilot diameter</li> </ul>
<b>Resistance</b>	1K - 20K
<b>Range</b>	Up to 355 degrees
<b>Linearity</b>	± 0.5%
<b>Output Smoothness</b>	<0.1%
<b>Resolution</b>	Infinite
<b>Operating Temp</b>	-65°C to 125°C
<b>Rotational Life</b>	50 million cycles min.
<b>Typical Apps</b>	Rocket engine fuel valves, brake pedals



**6900 Series**  
Element/Wiper/Insul

<b>Package</b>	<ul style="list-style-type: none"> <li>• 17.81 mm - 45.85mm / .702 in - 1.805 in element outside diameter</li> <li>• 4.724 mm - 11.05mm / .186 in - .435 in element inside diameter</li> <li>• 3.175 mm - 6.35 mm / .125 in - .250 shaft insulator inside diameter</li> <li>• 4.064 mm - 7.80mm / .160 in - .307 in mating wiper inside diameter</li> <li>• 5.08 mm / .200 in assembled package height</li> </ul>
<b>Resistance</b>	1K / 5K/ 10K
<b>Range</b>	Up to 350 degrees
<b>Linearity</b>	± 0.5%
<b>Output Smoothness</b>	< 0.1%
<b>Resolution</b>	Infinite
<b>Operating Temp</b>	-65°C to 125°C
<b>Rotational Life</b>	50 million cycles min.
<b>Typical Apps</b>	Cargo handling systems, cockpit controls



**6100 Series**  
Hollow Shaft

<b>Package</b>	<ul style="list-style-type: none"> <li>• 27.94 mm - 66.5 mm / 1.100 in - 2.62 in housing diameter</li> <li>• 3.175 mm - 19 mm / .125 in - .752 in hollow shaft diameter</li> </ul>
<b>Resistance</b>	1K - 20 K
<b>Range</b>	Up to 355 degrees
<b>Linearity</b>	± 0.5%
<b>Output Smoothness</b>	< 0.1%
<b>Resolution</b>	Infinite
<b>Operating Temp</b>	-65°C to 125°C
<b>Rotational Life</b>	50 million cycles min.
<b>Typical Apps</b>	Targeting pod gimbals, missile thrust diverters

## Linear Position Transducers Cable Extension Transducers



**M150, MTA**

<b>Range</b>	0 - 1.5 to 0 - 5 inches
<b>Output</b>	Voltage divider
<b>Environment/ IP Rating</b>	IP50
<b>Enclosure</b>	Aluminum
<b>Accuracy</b>	±0.4% to ±1%
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• M150, one of the world's smallest stringpot</li> <li>• Designed for space-critical and testing applications</li> </ul>
<b>Operating Temp</b>	-40°C to 85°C (M150) -55°C to 100°C (MTA)
<b>Dimensions (mm)</b>	19 x 19 x 10 (M150)
<b>Typical Apps</b>	Aerospace



**MT2, MT3**

<b>Range</b>	0 - 3 to 0 - 30 inches
<b>Output</b>	Voltage divider, incremental encoder
<b>Environment/ IP Rating</b>	IP50, IP67 (MT3A)
<b>Enclosure</b>	Aluminum and polycarbonate
<b>Accuracy</b>	±0.25% to ±1.1%
<b>Unique Features</b>	<ul style="list-style-type: none"> <li>• Designed for test applications</li> <li>• Dual-axis measuring cable alignment</li> <li>• Tracks high-acceleration linear position up to 136g's</li> <li>• High-frequency response</li> <li>• GAM EG 13 certification</li> </ul>
<b>Operating Temp</b>	-55°C to 125°C
<b>Dimensions (mm)</b>	55 x 45 x 55
<b>Typical Apps</b>	Aerospace and flight testing



**5903 / 5905 Series**  
Linear Motion

<b>Package</b>	<ul style="list-style-type: none"> <li>• 7.94 mm - 12.7 mm / .312 in - .500 in housing diameter</li> <li>• 1.98 mm - 3.18 mm / .078 in - .125 in shaft diameter</li> </ul>
<b>Resistance</b>	1K / 5K / 10K
<b>Range</b>	5903 series - up to 50.8 mm / 2 in stroke 5905 series - up to 101.6 mm / 4 in stroke
<b>Linearity</b>	±1%
<b>Output Smoothness</b>	<0.1%
<b>Resolution</b>	Infinite
<b>Operating Temp.</b>	-65°C to 125°C
<b>Rotational Life</b>	50 million cycles min
<b>Typical Apps</b>	Flight control actuators, targeting pod gimbals, nose wheel position

## Position Sensors

Linear Position Transducers, Inductive Absolute



### M12

Package	AISI-304 Series Stainless steel
Linearity	±0.25% of range
Excitation	AC operated
Output	AC voltage
Range	±10 to ±100 mm
Unique Features	<ul style="list-style-type: none"> <li>• Metric series</li> <li>• High stroke to length ratio</li> <li>• Constant sum of secondaries</li> <li>• Excellent temperature coefficient</li> </ul>
Operating Temp	-55°C to 150°C (220°C optional)
Diameter (mm)	12
Typical Apps	Hydraulic spool valve position feedback, flight simulators, engine thrust reversers

Angular Position Sensors, Hall Effect Absolute



### H005 / H009 Series

Package	<ul style="list-style-type: none"> <li>• 12.7 mm - 22.19 mm / .500 in - .875 in housing diameter</li> <li>• 3.170 mm / .1248 in shaft diameter</li> <li>• 16.9 mm - 17.4 mm / .670 in - .680 in housing length</li> </ul>
Range	Up to 359 degrees
Output Options	Analog / PWM / Serial
Resolution	12 Bit - Analog / PWM 14 Bit - Serial
Linearity	± 0.2%
Nominal Supply	5 volts
Operating Temp	-40°C to 150°C
Rotational Life	> 100 million cycles (bearing life)
Typical Apps	Missile fin actuation

### H009-1200 Series Dual Output

Package	<ul style="list-style-type: none"> <li>• 22.23 mm / .875 in housing diameter</li> <li>• 3.170 mm / .1248 in shaft diameter</li> <li>• 26.1 mm / 1.03 in housing length</li> </ul>
Range	Up to 359 degrees (dual output)
Output Options	Analog / PWM / Serial
Resolution	12 Bit - Analog / PWM 14 Bit - Serial
Linearity	± 0.2% (dual output)
Nominal Supply	5 volts (dual output)
Operating Temp	-40°C to 150°C
Rotational Life	> 100 million cycles (bearing life)
Typical Apps	Missile fin actuation

## Vibration Sensors

DC Accelerometers



### 3038

Package	SMD
Type	MEMS, Board level
F.S. Range (g)	±50, 100, 200, 500, 2000, 6000
Unique Features	<ul style="list-style-type: none"> <li>• Hermetically sealed</li> <li>• High over-range protection</li> <li>• Gas damping</li> </ul>
Accuracy	±0.5% Non-linearity
Excitation Voltage	—
Operating Temp	-54°C to 125°C
Dimensions (mm)	7.62 x 7.62 x 3.3
Typical Apps	Vibration / shock monitoring, embedded systems, shock testing, safe and arm



### EGAXT

Package	Stainless steel
Type	Plug and Play, Unamplified, Adhesive / Screw mount
F.S. Range (g)	±5 through 2500
Unique Features	<ul style="list-style-type: none"> <li>• Sub-miniature</li> <li>• Lightweight</li> <li>• 10,000 g over-range protection</li> </ul>
Accuracy	±1.0% Non-linearity
Excitation Voltage	—
Operating Temp	-40°C to 120°C
Dimensions (mm)	7.2 x 4.6 x 4.6
Typical Apps	Flight test and control, launch, crash, impact testing, robotics



### 4602/4604HT

Package	Anodized aluminum
Type	Plug and Play, Amplified, Screw mount
F.S. Range (g)	±2, 10, 30, 50, 100, 200, 500
Unique Features	<ul style="list-style-type: none"> <li>• Exceptional temp compensation</li> <li>• HT version to 170°C</li> <li>• High over-range</li> <li>• Hermetically sealed</li> </ul>
Accuracy	±1.0% Non-linearity
Excitation Voltage	8 - 36 Vdc / 8 - 18 Vdc (HT)
Operating Temp	-54°C to 170°C (HT)
Dimensions (mm)	21.08 x 21.59 x 7.62
Typical Apps	Flight testing on engines, flutter test, weapons development

## Vibration Sensors

DC Accelerometers  
Plug and Play



### 3420XA

Package	Anodized aluminum
Type	±1 to 500
F.S. Range (g)	Triaxial
Unique Features	<ul style="list-style-type: none"> <li>Analog output</li> <li>Precision aligned</li> <li>Performance over temperature</li> </ul>
Accuracy	±0.2% Non-linearity
Excitation Voltage	8.5 to 36 VDC
Operating Temp	-40°C to 85°C
Dimensions (mm)	24 x 24 x 28.30
Typical Apps	Safety system, military research and development



### 3520XA

Package	Anodized aluminum
Type	±1 to 500
F.S. Range (g)	1, 2, or 3
Unique Features	<ul style="list-style-type: none"> <li>Digital output</li> <li>Direct to PC</li> <li>User configurable settings</li> </ul>
Accuracy	±0.2% Non-linearity
Excitation Voltage	8.5 to 36 VDC
Operating Temp	-40°C to 85°C
Dimensions (mm)	52 x 36.50 x 17.50
Typical Apps	Impact detection, stores separation

Piezoelectric Accelerometers  
Plug and Play



### 7202A/7204A

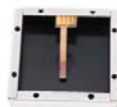
Package	Stainless steel
Type	Voltage mode plug, through hole mount
Sensitivity (mV/g)	100, 10
Unique Features	<ul style="list-style-type: none"> <li>Annular shear mode</li> <li>Integral strain relief</li> <li>Case isolated, internally shielded</li> <li>3-pin connector</li> <li>+150°C option</li> </ul>
Operating Temp	-55°C to 130°C
Dimensions (mm)	13.34 x 19.05
Typical Apps	HUMS applications, rotor track and balance

## Piezo Film Sensors



### Piezo Cable

Package	Shielded coaxial 20 gage piezo cable
Type	Polymer jacketing; armored jacketing
Range	µPa sensitivity
Unique Features	<ul style="list-style-type: none"> <li>Continuous lengths to 1km</li> <li>Shielded construction</li> </ul>
Accuracy	±20% (typical)
Operating Temp	-40°C to 85°C (up to 100°C available)
Dimensions (mm)	3 mm diameter; continuous lengths
Typical Apps	Geophone, impact sensors, intrusion detection



### Tamper Box

Package	Flat film or box mounted
Type	Tamper detection sensor
Range	Application dependent
Unique Features	<ul style="list-style-type: none"> <li>Low power</li> <li>Custom shapes and sizes</li> <li>High security</li> </ul>
Accuracy	Application dependent
Operating Temp	-40°C to 85°C
Dimensions (mm)	Application dependent
Typical Apps	Encryption modules, POS card readers, PIN entry devices, tamper

## Ultrasonic Sensors

Standard Contact Point Level



### LL-01

Type	Gap
Unique Features	<ul style="list-style-type: none"> <li>All 316L SS</li> <li>Integral electronics</li> <li>Miniature threads</li> <li>Single machined</li> <li>No adjustment for viscosity, density</li> </ul>
Input	6 - 24VDC
Output	1/2A contact
Pressure	250 psi
Temperature	100°C
Actuation point	0.25"
Process Connection	1/4"NPT & 1/2"NPT
Cable	12"
Approvals	CE
Typical Apps	Compressors, coolant reservoirs



### LL-10

Type	Tip
Unique Features	<ul style="list-style-type: none"> <li>All 316L SS</li> <li>Integral electronics</li> <li>No adjustment for viscosity, density</li> </ul>
Input	9 - 24VDC
Output	1A SPDT
Pressure	1000 psi
Temperature	100°C
Actuation point	2.25" standard
Process Connection	3/4"NPT
Cable	12"
Approvals	CE
Typical Apps	Hydraulic reservoirs, dark water

PRODUCT AND APPLICATION MATRIX	Flow	Fluid Property	Force/Torque	Humidity	Liquid Level	Rate/Inertial	Position	Pressure	Temperature	Ultrasonic	Vibration/Shock
	Cockpit Controls			●				●			
Flight Controls and Actuation			●				●				
Landing Gear & Brakes			●				●	●			
Cabin, Galley & Cargo				●	●		●	●	●	●	
Launch & Space			●				●	●	●		●
Engine, Turbine & APU	●				●		●	●	●		●
Military (Missile, Ground Vehicle, Marine, UAV...)	●	●			●	●	●	●	●	●	●

**[www.te.com/aerospacedefense-sensorsolutions](http://www.te.com/aerospacedefense-sensorsolutions)**

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